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CASE Network
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No. 428/2011

Warsaw Bishkek Kyiv Tbilisi Chisinau Minsk

This paper was prepared with support from the Commission of the European Communities within a project entitled "Knowledge-Based Entrepreneurship: Innovation, Networks and Systems" (Contract no. CT2-CT-2004-506022), funded by the European Union's Sixth Framework Programme.
This paper has been financed thanks to the assistance of the PEKAO SA.

Keywords: **Knowledge-based economy, Entrepreneurship, Transition, Post-communist, SMEs, Case studies, Croatia, Czech Republic, Hungary, Lithuania, Poland, Romania**

JEL Codes: **L26; O31; O52; P27**

Graphic Design: Agnieszka Natalia Bury

EAN 9788371785467
Publisher:
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Abstract

This paper focuses on knowledge-based entrepreneurship, or new firm creation in industries which are considered to be science-based or to use research and development intensively, in the East Central European (ECE) context. On the basis of case studies of thirteen knowledge-based firms in six ECE countries, we suggest that KBE firms in these countries may differ in some important ways from the conventional picture of new technology based firms. In general, we see the ECE knowledge-intensive firm as a knowledge-localiser or customiser, adapting global knowledge to local needs on the domestic market, rather than a knowledge-creator generating new solutions for global markets. The entrepreneurs who start and run these businesses are skilled at spotting trends early and bringing them to their countries. Based in countries that generally have poor reputations as sources of innovative, high-technology products, but having established strong brands for themselves in their home markets, they are struggling with the challenge of entering export markets with products and services that can achieve global, or at least regional, recognition. The studies of the companies discussed here suggest that ECE firms are still in the early stages of this strategic shift.

1. Introduction[1]

The explosion of new firm creation the post-Communist economies of East Central Europe (ECE) has been explored in a large literature on the subject, and its role in the restructuring and revitalizing of those economies has been crucial.[2] It is a well-established fact that much of this entrepreneurial wave has occurred in sectors such as services and trade, neglected under central planning. This paper focuses on an area of entrepreneurship which appears to be both underdeveloped and under-researched in the ECE context, but which is of particular importance for the modernization of these economies: knowledge-based entrepreneurship (KBE), or new firm creation in industries which are considered to be science-based or to use research and development (R&D) intensively.

We proceed as follows: in the second section, we present the theoretical issues involved in the study as well as the research questions examined. In the following section we discuss the research design and the group of companies studied. The fourth section, in which we discuss our findings, makes up the bulk of the paper. We begin with the initial conditions of the firms, looking at the composition of the founding team, the knowledge inherited from their work for their previous employers, and the sources of the innovative ideas on which these businesses have been built. Next, we look at the resources at the disposal of these companies, including questions of finance, intellectual property and its protection, and policies for the development of personnel. In the fourth section, we analyse issues of a strategic nature, first characterising the markets on which the companies operate and moving on to discuss the evolution of company strategies, their growth paths and success factors. The fifth section includes an analysis of the various relationships in which the firms are involved and how they affect the innovation processes in the firms. In the fifth and final section we summarise and conclude.

[1] The authors are solely responsible for the views expressed herein; this paper does not represent the opinion of the European Community, and the European Community is not responsible for any use that might be made of data appearing herein. The authors would like to thank local experts that have collected or/and organised data collection: Andrea Szalavetz in Hungary, Anna Kaderabkova in the Czech Republic, Martina Hatlak in Croatia, Justyna Mocko in Poland, Radu Gheorghiu in Romania and Monika Kriaucioniene in Lithuania.

[2] See, for example, Hoshi et al. (2002) and Aidis (2005).

2. Theory and research questions

We will not go into the various general theories of entrepreneurship of Schumpeter, Kirzner, Baumol, etc., here. Rather we will note only that, for our purposes in this paper, the concept is broader than the "standard" model of entrepreneurship, referring to a risk-taking individual; we also include "academic entrepreneurship" (defined as the creation of spin-off companies by academics on the basis of research carried out at institutions of higher learning; probably the most influential work on this subject is that of Etzkowitz[3]) and "corporate entrepreneurship." We use this term to refer to the behavior of large incumbent firms when the most important (for our purposes) characteristics of that behavior are rather dynamic and entrepreneurial than bureaucratic (corresponding to Schumpeter's prediction that innovation would, in fact, be driven by such large corporations rather than by small enterprises).

What, then, is knowledge-based entrepreneurship, and what makes it a special form of entrepreneurship? KBE is difficult to define precisely. After all, every form of entrepreneurship is based on the exploitation of some form of knowledge, if only about arbitrage opportunities. Concern about KBE is related to the broader interest in the so-called Knowledge-Based Economy, which is defined in terms of the growing ratio of intangible to tangible assets on corporate balance sheets and the increasing R&D intensity of economic activity in recent decades. Clearly, then, in talking about KBE, we must restrict ourselves in our definition to activities in which the role of the generation of new knowledge is central to value creation; that is, we must focus on the commercialization of scientific and technical innovation. However, even with this proviso, it is difficult to formulate an operational definition. Obviously, major innovations can occur in any industry, no matter how traditional (for example, R&D budgets are often high in extractive industries, and the food industry is often considered to be currently undergoing a transformation from a low-tech to a medium-tech or even high-tech industry; see von Tunzelmann and Yoruk, 2004). Should we look at firms with a high patent intensity? With a high R&D intensity? Or should we base our research on industrial classifications, looking at industries which are considered "science-based" or R&D intensive, such as pharmaceuticals or information and communication technologies (ICT)?

In the research presented here, we have decided to focus on industries or sectors regarded as being R&D-intensive (see section 3 for more detail on how this is defined).

[3] See, for example, Etzkowitz (1983, 2003).

In the research presented here, we attempt to answer the following questions about the development of Knowledge-Based Entrepreneurship in the ECE countries. First, we are interested in exploring the collective, or distributed, nature of entrepreneurship (Hirschman, 1958, Knight, 1921; Tsoukas, 1996) and the assignment of various elements of the entrepreneurship function to members of the entrepreneurial team. Here, we ask who performs the entrepreneurship function: is it limited to one individual, as in the classic conception of the entrepreneur, or do we observe teams of entrepreneurs? And in the latter case, how is (are) the entrepreneurial function(s) divided up amongst the various participants?

We are also interested in developing a more refined classification of knowledge-based, or knowledge-intensive, firms. For example, can we distinguish among various kinds of knowledge-based entrepreneurship with respect to the role knowledge actually plays in these businesses – are they, for example, knowledge-creators (new technology based firms), or are they knowledge-customizers, bringing global technological knowledge into a particular local context and adapting it to that context? In pursuing this goal we ask a number of supplementary questions. For example, we attempt to classify the strategies of the firms, asking whether they are pursuing growth (and if so, what kind of growth – expansion into foreign markets, diversification of product lines, etc.) or are satisfied with a relatively stable niche market. Similarly, we ask what the motivations of the entrepreneurs were at the time the firms were founded – were they exploiting a market opportunity and thus pursuing a primarily commercial set of goals, or were they simply using commercialisation as an alternative source of funding for their research after the collapse of the Soviet bloc R&D system? (A number of related issues are explored here, such as the level of the founders' satisfaction with their previous employment, the benefits they obtained from that employment in terms of skills and capabilities, etc.).

A further issue shedding light on the way knowledge is used by these firms concerns the sources of innovation. We ask about innovation networks: what is the role of customers, suppliers, the science sector (universities and industrial research institutes)? Do we, for example, observe the kind of user-led innovation described by Eric von Hippel (1988, 2005)? Finally, defining the types of markets (customers) targeted by these companies (e.g., export or domestic markets, consumer markets or specialized clients, often operating in the science sector) should help us in our effort to develop a typology of ECE knowledge-intensive firms.

We are also interested in the question of access to financial resources for knowledge-based companies in the transition context, given what we know about the difficulties that small firms – especially innovative and knowledge-based ones, whose key assets are intangible and

therefore cannot be used as collateral – experience generally in accessing external finance (whether equity and loans), both on the supply side (due to the higher level of risk) and the demand side (due to the reluctance to relinquish control over the firm in the case of equity investments) (on the difficulties in accessing finance by KB SMEs, see, for example, Ben-Ari and Vonortas, 2005). Is this difficulty a crucial constraint on the growth opportunities of knowledge-based firms in ECE countries? This is one of the questions we explore here. The question of the role of patenting is also of interest: is the low level of efficiency of national patent offices in registering, and of courts in enforcing, intellectual property rights a barrier to innovative entrepreneurship in these countries?

3. Research design and the firms studied

The firms studied here are from six ECE countries, all but one of which are new members of the European Union: Croatia, the Czech Republic, Hungary, Lithuania, Poland and Romania. The 13 firms were taken from a larger sample of knowledge-based companies analysed within WP 3 of the KEINS project. This sample was selected on the basis of industrial classification, with the selection of targeted industries based on a statistical classification of activities considered to be knowledge-based (BC Stats, 2001; Clendenning & Associates, 2000). From each country we have selected two firms, except in the case of the Czech Republic, from which we present three case studies. In choosing firms for in-depth case studies, we attempted to select firms that would be particularly interesting from the point of view of Knowledge-Based Entrepreneurship (KBE) due to a relatively high R&D intensity (in terms of the ratio of R&D expenses to total sales revenues).

There are admittedly flaws in the industry-based selection criteria used to create the larger sample from which these companies are drawn. First, with this approach we are not able to identify firms that have knowledge-based or high-tech processes but produce traditional products; i.e., our classification is still product-based. Second, not all firms with industrial classifications placing them in high-tech and knowledge-based industries are themselves high-tech or knowledge based (some distinctions in this regard will be discussed at greater length later in this paper). However, any other approach to the identification of knowledge-based firms would be prohibitively costly, and we believe that the studies of the firms included here (against the background of our analysis of the larger sample undertaken within WP3) have allowed us to identify some interesting characteristics of ECE knowledge-based

firms, giving us grounds for some enlightening comparisons with similar firms in higher income countries.

The firms studied here include five firms in IT (software), three in pharmaceuticals (including skin care products), two in optoelectronics, one in electronics, one in advanced medical equipment and one in advanced materials. With respect to size, some of them are small firms that are unlikely to grow to a much larger size, others are more dynamic and have already entered the medium size category, with employment over 50 persons.

4. Analysis

4.1. Beginnings

Founding team. Eleven out of thirteen firms examined here were founded by small teams numbering between two and six persons. Only two companies (one Hungarian and one Lithuanian) were founded by a single entrepreneur. Usually we can identify separate team members contributing S&T skills on the one hand and business skills on the other. This illustrates thedistributed nature of entrepreneurship, with various members responsible for two separate aspects of the entrepreneurship role (the creation of ideas and their commercialisation); on the other hand, we also see that the teams involved are relatively small. (Over time, some of the founding teams have seen evolution, with their composition changing; we observed five founding teams in which such changes occurred, seven in which they did not, and two (Lithuanian) cases for which we do not have information on this subject.) The inventor-founder often integrates S&T skills with R&D management and other business skills and often cooperates with foreign partners in international programmes (the best example of such integrations of entrepreneurial functions in one person is the one-founder Lithuanian firm, an example of academic entrepreneurship). In some cases, however, the prime inventor in the founding team has skills which are limited to the purely scientific area of the company's operations and leaves the running of the business to other members of the team.

In spite of this distributed nature of entrepreneurship, in those firms that we can consider to be truly knowledge-creating (science-based) firms, it seems possible to identify a single person as the core inventor. This seems to pose potential problems for the firm in terms of succession, as this person appears as an irreplaceable asset. In Weberian terms, this person

serves as the source of *charisma* in this subset of firms, whereas in the entire group of firms we observe a trend toward the gradual professionalisation of management corresponding to the Weberian transition from charismatic to *bureaucratic* organisation. This leads to the question of the professionalisation of the intellectual property creation process itself, a question studied intensively in the literature on innovation at least since the days of Schumpeter's observations concerning innovation in large corporations (Schumpeter, 1962). Will these ECE KBE firms be able to manage this transition, and if so how? This remains to be seen.

Inherited knowledge. In twelve out of thirteen firms science and technology (S&T) knowledge that entrepreneurs brought with them into their new organisation was developed in an organisation in which founding team members were previously employed. In only one enterprise was the knowledge employed acquired outside regular employment, through PhD study. This suggests that the main motive for entrepreneurs in setting up their businesses was market opportunity, i.e., the exploitation of knowledge previously acquired in a new market context. On the one hand, one of the main incentives for academic entrepreneurship in ECE countries (particularly in a country like Lithuania which was once a part of the Soviet Union) appears to be the collapse of the Soviet R&D system (including R&D funding), which was not replaced by national R&D funding, forcing at least some researchers to seek other sources of funding through commercialisation. Sometimes structural deficiencies with respect to the linkages of research and industry in transition countries have presented entrepreneurial opportunities to researchers, who commercialise research facilities (a good example is a Romanian pharmaceutical company whose founding team is composed of researchers who took advantage of the lack of research units in big pharmaceutical plants at the beginning of transition and grew the research institute into a production unit). In only three of the firms, however, did the knowledge acquired by the founder(s) in previous employment include business experience. In these cases, the inventor-founder started developing multiple sets of skills during the previous work experience, accumulating not only scientific knowledge but also managerial capabilities by rising to managerial status with that previous employer. Moreover, these persons have sometimes complemented their scientific training with post-graduate studies in economics at the university (a good example is the one-founder Romanian electronic company).

One of the motives frequently cited by the persons interviewed was dissatisfaction with the work environment at their previous employer, which they felt gave them inadequate opportunities for development. This would seem to reflect a pattern observed by Steven Klepper: prior to setting up new businesses, innovative entrepreneurs usually try hard to stay

in their organization and promote their ideas from within, and when they finally leave it is because they have finally come to the conclusion that this is impossible (see Klepper and Thompson, 2006). It is also consistent with Klepper's observation that entrepreneurs (specifically, new market entrants) usually come from the same, or a related, industry as that of the firm they are starting up (comments at KEINS conference, Milan, June 4-5, 2007).

It is worth noting that the previous employment experience of the entrepreneurs in this small group of firms seems not to be representative compared to the sample as a whole, as state-owned enterprises and other state institutions (including universities) definitely dominate in our case study companies. This is probably linked to the fact that a much larger proportion of our case study companies were founded before 1990 than is the case in the sample (only 17%). We also observe one (particularly interesting) case – a Hungarian advanced materials firm – where one of the team members was previously employed by a firm that has now become a customer: a rare case in which previous employment has been instrumental in providing not only knowledge but business opportunities.

Sources of innovative ideas. The small team nature of KBE in our group of firms has also been confirmed with regard to the sources of innovative ideas. An inventor is rarely the sole source of ideas (only in the case of one enterprise has this been the case). Most often the source of ideas is an inventor in cooperation with team members. This feature of firms is connected largely with the nature of their knowledge generation activity, and here in turn we can make a very important observation about the distinctions among our firms. A number of them are focused on localization activities (that is, they provide customisation of internationally recognised products or services to local customers). This is particularly true of the IT firms. On the other hand, one could argue that in four cases the degree of novelty of the products invented by the firms justifies their classification as new technology based firms. Additionally, four firms, while not qualifying as full-fledged new technology firms, go beyond knowledge localisation or customisation, as they are developing genuinely innovative products. In cases of localisation, most often the knowledge dimension of the products customised and services provided is distributed in the form of organisational capabilities rather than new technical novelties. Thus, our case studies allow us to deepen the analysis of the larger sample presented in WP3, where we divide ECE KBEs into rather rare new technology based firms on one hand, and two other groups on the other: networkers and firms with customer-oriented organizational capabilities. We will develop this theme further later.

In two cases – a Hungarian advanced materials firm and a Lithuanian advanced medical equipment firm – we also observe customers as sources of innovative ideas alongside the

founder-inventor, which in the case of Lithuanian advanced medical equipment firm led not only to the start of the company but also to the development of innovation networks (we will have more to say on this subject later).

Serial entrepreneurship. Serial entrepreneurship in our group of firms is very limited. There is a firm whose founding teams have set up two more companies in related areas to create a group. In another case, the founding team sold their first company to the second largest domestic producer in the industry and then started a second company from scratch in the same area. This is a story of disappointment on the side of the founding team, and also illustrates how acquisitions by big companies might involve disruption of innovative skills and products (which it fears as a potential competitor in the market) instead of taking the opportunity to internalise them for its own growth. In this case, a small entrepreneurial company started as a small research unit with 7-8 people (who were working in research institutes in communist times) in the early transition years and grasped the opportunities of the market deficiencies to build a production unit employing almost 100 people by 2005. The company also had a portfolio that grew to 60-70 products in 2005, some of them introduced to the market for the first time by a domestic producer. During the sale of both the research and production units of the company, the founding team members were content that the acquirer would make good use of their 'jewelry' portfolio of 60-70 products. The founding team members soon found themselves without jobs, and what is more, even the recipes of their products were not taken up by the new owner. The acquirer preferred gradually to erase these products from the market and let the products die slowly. A group of people in previous founding team, facing all the challenges in the post-transition market, came together to set up a brand new company in the same area.

There are no other genuine serial entrepreneurs in the founding teams of our firms who have remained involved with those firms. In three firms we observe founding members who have become serial entrepreneurs, but only after having left the firms studied here to pursue their new ideas. In three further cases we observe more than one registered corporate entity owned by the founders; however, this can be treated as a formality rather than genuine serial entrepreneurship, as in fact in these cases the legally separate entities in fact constitute a single business. This is hardly surprising, given the nature of the firms' capabilities, as well as the need for firms to grow based on retained earnings, meaning that development requires more time, making such firms less suitable for the activity of serial entrepreneurs. In addition, the dearth of available exit strategy options (due to the underdevelopment of capital markets) in all the countries represented in this group of companies creates further difficulties for serialization of entrepreneurship.

4.2. Resources

Finance. In only one of the companies we studied here – a Czech company with a strategic investor – was external funding (either in the form of debt or investment from a strategic investor) crucial for its growth. In a minority of the firms, external funding has been important for growth, but retained earnings have still played the largest role in growth. Similarly, in four cases (not including the two Lithuanian cases, to which we will return in a moment) we see a role played by grants from national ministries (including research grants) or the European Union; however, in none of these cases has such assistance been of truly strategic importance. In three cases, external funding has not been obtained at all. The relatively low importance of external finance in the group as a whole most likely reflects the difficulties mentioned in section 2 for small firms, especially those in knowledge-intensive activities, in attracting outside funding. However, two firms in the group we studied – Lithuanian examples of academic entrepreneurship – have received foreign *and* national grants particularly for their research that yield new innovations. Foreign grants are from US Department of Defence, the EU's Framework Projects and Structural Funds, and NATO, while the national grant is from Lithuanian Science and Study Foundation. Moreover, one of these firms, despite its difficulties (particularly in negotiation and achieving consensus with the foreign venture capital investor), continues to grow with foreign venture capital, due to the scarcity of venture capital in ECE. Some claims exist in the literature that small businesses experience even greater difficulties in ECE countries than in other countries (see, for example, PricewaterhouseCoopers, 2005); although our Romanian companies support this, testing of this hypothesis would require research on large samples including companies from both the old and new member states of the EU.

Two of the companies have attracted strategic investors. The appearance of a strategic investor (particularly in the case of financial investors such as venture funds) often leads to significant organizational change (e.g., by bringing in new management to remedy the lack of business skills in KBE companies and narrowing the previous management's role to responsibility for product development). Here one Polish firm with a strategic investor constitutes an "exception that proves the rule", because while little organisational change resulted from this investor's involvement, this is due to the fact that the investor went bankrupt; however, even here they had to spin off part of their organization. Indeed, this common consequence of strategic investor involvement is one reason why entrepreneurs often prefer to do without such investors, even when their involvement would allow the firm to grow much faster.

Intellectual Property Rights. The important role of firm-specific capabilities is confirmed by the nature of IPRs in the firms studied. Only two firms – both Lithuanian – have international patents (US and EU) that are considered to be their *core assets*. While one of them has built up patenting capabilities in the US and EU patent systems on the basis of experience with patenting in the Soviet system, the other company inherited its patenting capability from the R&D potential and patents of the Institute of Physics in Lithuania (of which it is a spin-off). By means of international patents, both companies have gained access to international research finance, which has enabled them not only to enter niche markets but also to sustain their positions in those niches.

Among the other ECE firms in our sample, only one Polish enterprise has been filing patent applications for 6-7 years without achieving the registration of a patent, which has forced the company to re-evaluate its patenting strategy according to the slow national patenting system. Indeed, the other Polish firm we studied also has patentable products but does not patent due to the very slow and cumbersome patenting procedure in Poland, relying instead on secrecy and continuous innovation (i.e., improvement of the product). This may, however, be a weakness for the company, in that it increases their need for caution in R&D collaboration (this observation about the weakness of IP protection as a barrier to R&D collaboration has also been made in other Polish research; see Woodward et al., 2005). Five companies, on the other hand, have products and services that are not patentable (particularly in IT). In short, other than the two Lithuanian companies with over 10 international patents each, for none of them is patenting of strategic importance.

Personnel. Obviously, in knowledge-intensive firms the development of the skills and knowledge of company personnel should play an especially important role. Five of the companies explicitly commented on the weight they place on the systematic development of personnel skills through encouraging their employees to obtain doctoral degrees and/or improve their industrial knowledge and engineering abilities (e.g. the Lithuanian interviewees emphasised the importance of engineering for the ability to develop industrial applications, i.e. innovations).

In the recruitment activities of the firms, there is a clear and tight link between the universities and/or institutes and the firms categorised as academic entrepreneurships. Still, most of the firms prefer to employ recent graduates (with and without postgraduate degrees) from the universities to work in R&D and product development. One of the Romanian firms particularly emphasises the importance they give to recruiting and training young people in order to grow through building a long-term team; in other words, to establishing organisational capabilities. The founders of the other Romanian firm make use of teaching at the university to create a

pool of successful students to be recruited, while two Polish firms use the internship of students (including foreign internships) as a basis for creating a pool of candidates with potential for future recruitment (they prefer to recruitment internally, and only afterward externally). One of these firms has very low turnover, a result of its strong efforts to create a friendly working environment (especially in terms of offering flexibility to female employees, important in countries where there are scarce day-care options open to working mothers), and a large training budget (for example, the firm covers half of the cost of postgraduate taught degrees obtained by employees). Other firms also consider personnel as their strategic asset but do not have in place system for development of personnel skills. However, in attractive sectors like electronics and in relatively poor ECE countries such as Romania, multinational corporations' ability to attract good students with offers of scholarships and good pay might be a problem for small players.

The Romanian electronics company raised the issue of brain drain, particularly since mid-1990s, when the average employment period reduced from 5-6 years to 2-3 years, causing a high rate of staff turnover. The company is adversely affected when young employees in whose training abroad the company invests time and money leave the country for very high salaries abroad at the end of their 3-year contract, taking with them the human capital in which the company has invested. It is rather surprising to hear the company complaining not about financial problems but problems in human resources: "The stakeholders want to invest more money but we do not need money. We need good [talented and specialized] people. We can not develop our business not due to the lack of money but due to the lack of people".

4.3. Strategies

Markets. Most of the firms studied here are oriented towards the domestic market. Six firms are not exporting at all, and four are exporting but to a modest degree. Only three could be considered serious exporters. This geographic orientation is compatible with the firms' capabilities, which are often in the localisation of foreign generic solutions and the application of world frontier solutions to the markets of the ECE countries. However, a review of the comments of the interviewees from the firms suggests that most of them see the development of export opportunities as one of the main opportunities for growth, perhaps the greatest: seven of the firms see their future growth as linked to growth prospects on the foreign market, while only six see similar prospects for growth on the domestic market. The lack of national policies in some of the ECE countries may limit the growth prospects of some KBEs.

With regard to the institutional composition of the client base, only three firms are selling on consumer markets, while five sell to public sector customers and six sell to both the public and private sector. It is worth noting the relatively high number of firms in this group who have public sector customers. This is broadly compatible with the data from the large sample of firms studied in WP3. This indicates that these firms have been successful in overcoming the barriers to provision of products and services based on innovative technologies to public sector customers in ECE countries (see Woodward, 2006), and/or that these barriers might not be as important as had previously been thought. We did, however, observe a disappointment with public sector as a client, when the innovative "intelligent house" project run jointly by the Romanian electronics company and the government was wasted, though since the problem here lay in the inability of the government to sell the houses, blame might more properly be laid at the door of low incomes in the country, forming a barrier for demand for innovative and complex high-tech products. One Polish new technology based firm (in the area of optoelectronics) is the producer of room-temperature infrared detectors (most infrared detectors operate at cryogenic temperatures). The interviewee from this company made the interesting claim that they would prefer not to be a monopolist on a small market, as this means that potential clients are afraid of being locked-in and may for that reason choose to stick with alternative technologies, even if they are in some ways inferior, as a way of reducing risk in the longer run.

Finally, on the subject of markets, there seems to be evidence of a positive correlation between degree to which firm is knowledge-creating (i.e. is new technology based) and its export intensity[4].

Strategy. In our group of companies we observe several examples of important shifts in product profile or customer base. This provides yet another illustration of the importance of dynamic capabilities (Teece et al., 1997) for success: in the rapidly shifting environment of the post-socialist transition economy, the ability of companies to recognize when the possibilities contained in one line of activity have been exhausted and identify the type of change that is needed to ensure future success is of particular importance. . For example, with their second venture, the Romanian entrepreneurs discussed in the section on serial entrepreneurship have found themselves in market environment with huge differences from the early transition years in which their first venture was developed. While they have maintained the same research and development staff with the same innovative skills, they realised that their focus has to be different than before, so the company is now channelling

[4] We want to explore whether stronger export propensity of new technology based firms in relation to other two groups (networkers and customer oriented firms with organisational capabilities) is also present in the large sample studied in WP3.

its effort to develop not distinctive and completely new-to-its-market products but generics of the existing products that will appeal to low-income consumers in its domestic market. Also the company aims at outsourcing production to other local and European manufacturers with spare capacity rather than having a big production unit of its own.

The dominant strategic development pattern observed here is *diversification*, possibly due to unused organisational capabilities (Penrose, 1995). This generalisation follows from the following observations regarding the development of company strategies:

- in six enterprises the dominant pattern is diversification from products to services;
- in one of these firms, we observe a transition from distributor of IT products solutions to localiser of IT solutions;
- another firm undergoing such product-to-services diversification is also shifting from distribution of IT solutions to a system integration focus;
- in one firm diversification is driven by the specificities of its client base (this firm is a producer of advanced materials used in space research and its initial main customer was NASA; due to shifts in the priorities of US space policy, it is being forced to look for other customers, and this in turn is forcing it to diversify its product profile as well, adding non-space related products and services), and
- one firm is diversifying its customer base from the R&D sector to industry, and its activities from laser and light technologies to advanced medical equipment.

Success factors. The success of most of the companies studied could be ascribed to their being *trend spotters* rather than *trend setters*. In other words, their competitive advantage is based on early recognition of industry and market trends and then being able to deliver solutions and products reflecting those global trends, usually on the domestic market. In that respect, they are not so-called 'gazelles' (Rigbi et al., 2007) – that is, firms whose innovations have the potential to redefine markets and industry. In the case of the four genuine new technology based firms studied here, of course, technological and scientific capabilities are central success factors; for most of the other companies, which can be described as knowledge-intensive without being strong knowledge creators, abilities to adapt global solutions to local conditions have been more central. In fact, we observe a spectrum of companies in this respect, ranging from the four new technology based companies at the knowledge-creating end of the spectrum to IT service providers at the knowledge-localising end, and the relative weight of these success factors changes with respect to the company's position on this spectrum.

Another success factor utilised by the two firms dependent on domestic consumer markets was the ability to build a domestic brand. The leaders of these companies seemed to understand almost instinctively the importance of brand building as a means of product differentiation and development of customer loyalty.

Growth paths. We can differentiate three growth paths among the firms studied: generic expansion, mergers and acquisitions, and productivity based modes of growth. Only three firms have been growing entirely based on generic expansion (based entirely on retained earnings). Two other firms have been growing through a combination of generic expansion and mergers or acquisition of other firms with complementary skills or markets. Seven out of thirteen firms have been growing in terms of sales but not in terms of employment, i.e. their productivity has increased substantially but the firms have not expanded in terms of assets or employment. This latter group of firms are not high growth firms with products for large volume markets, and for some of them, dynamic growth is not a goal at all; they have found stable niches and are content to operate in them with stable and relatively low rates of annual revenue growth. This growth path is particularly characteristic of IT firms, but is also observed in the case of one new technology based firm (Lithuanian Vittamed) whose product is highly specialised and in the case of the electronics firm with both high staff turnover and large numbers of clients.

Two of the companies experiencing jobless growth (both of them Hungarian) and the two IT firms that are not oriented toward growth at all are at opposite extremes of the knowledge-creating / knowledge-localising spectrum referred to above. It would therefore be interesting to conduct further research to see how employment growth correlates with the degree to which the firm is knowledge-creating. Such a correlation, if it were found to exist, might have implications for labour market policy.

4.4. Relationships

Suppliers. The role of suppliers in the development of strategic assets (for these firms, knowledge assets) differs to a large extent depending on the industry of the company studied. For example, in the case of IT service providers, the role of the suppliers is usually confined to the provision of 'raw materials' (though knowledge intensive) in a way analogous to that of suppliers in manufacturing operations. Programming platforms being provided by global software giants such as Microsoft; these are then used to create customised software meeting a particular customer's needs, and this adaptation is carried out using in-house talent (though this is sometimes complemented on a project-by-project basis by bringing in outside programming expertise, which, however, rarely if ever comes from a supplier).

On the other hand, for the firms with in-house research, the suppliers either have strategic significance, particularly for innovation, or no role at all (among the new technology based firms, examples of the firms for whom suppliers are of no significance in the innovation process are the Polish optoelectronics and the Hungarian advanced materials firms). Three in-house research-based firms emphasise the significance of international suppliers, while a Lithuanian firm referred to the significance of the proximity of the suppliers for development of highly customised products (this firm even has a joint venture with one of its suppliers, although it is located in Siberia, which is hardly close). For the Polish company producing skin-care products, international suppliers of active ingredients constitute a very valuable source of information and ideas about the properties of those materials and are thus very helpful in pointing out new possible applications. For the Lithuanian advanced medical equipment producer, the success of the performance of the prototype products depends strongly on the components provided by both local and international suppliers, which are most often not easily available on the global electronic supply markets. The Romanian pharmaceutical firm prefers mainly foreign suppliers, as there are very few local synthesis laboratories left as a result of the transition. In addition, these laboratories produce very few active substances that meet the needs and requirements of the company, so most of the active ingredients are imported.

Customers. Links with customers are of strategic importance for eight out of thirteen firms, which further confirms that these are firms with customer-oriented organisational capabilities. In five others, links with customers are not of strategic importance; three of these are pharmaceutical firms (including skin-care products), which, although dependent on consumer markets, are not dependent on knowledge from customers. We observe three or possibly four firms in which links with customers are important for the innovation process itself (in the sense that the direction of product development work is affected significantly by customer input). However, in no case do we observe the involvement of personnel from customers in the actual development work. While customers are often essential in formulating specifications and requirements due to the customising nature of the product or service provided (particularly for IT firms, where this role is sometimes so extensive that the interviewees refer to customer representatives as consultants in projects), these links are not necessarily strategic, or are so only in a limited sense; for example, they may be crucial in determining the production profile of the firm, but not in determining its growth path.

Stable, long-term relationships with both customers and suppliers seem to be a general rule, something which is striven for even when there is significant evolution in product and customer profiles; many of these firms are producing products which are unique and

customized for each order/customer (particularly in IT but also in the case of the Hungarian advanced materials firm). The Lithuanian advanced medical equipment producer has even organized a specialised network whose members include potential target customers (such as hospitals and research laboratories). The product innovations of the firm are clinically tested, used and improved in close cooperation with the network's members, allowing the firm to access knowledge, experience and feedback from various scientific and practice communities. However, it is clear that in this group of companies there is no evidence of the sort of innovation by users discussed by Eric von Hippel (1988, 2005). Nevertheless, it is worth noting that in IT and in the case of the skin care products firm we observe the increasing sophistication of consumers, which in the long term probably has important positive implications for the development of demand for new technology based products and services.

All firms studied are at least to some extent, and in some cases strategically, linked to the public sector (for six of them – five IT firms and one medical equipment provider – the public sector is strategically important or the most important client). In discussing markets in section 4.3, we noted that this seemed surprising in the light of some earlier research. The interest of the public sector in knowledge-intensive products and services is certainly a promising development. However, it seems that public procurement is mainly related to introduction of IT related services in public administration rather then linked to policy of public technology procurement.

Horizontal linkages (science sector). When we consider links that are significant for the innovation process and that are not vertical links within the supply chain, but rather involve horizontal relationships between partners, we see that these are usually confined to partners in the science sector (universities and research institutes). In nine firms links with the science sector are either of some (three cases) or strategic importance (six cases). Four firms reported having no links with the science sector. This confirms that our sample is indeed to a large extent knowledge-based. However, we should not overly hastily conclude that the science sector in the post-socialist countries, often criticised for its lack of linkages with industry and technology transfer (Radosevic, 2004), is in fact playing a major role in these countries' innovation systems, as the role of science sector partners is usually confined to the provision of testing services and the contribution of new employees (in the case of university graduates). There is an initiative of the Czech government to fund a joint research project between firm**s**, university and R&D institute in the pharmaceutical industry; however, this is of limited significance for the Czech pharmaceutical company in our sample. The Romanian company complains about the mismatch between the education curriculum at the

university and the market realities, which prevents their potential collaboration with universities for research. The company also complains about the lack of support by the government with a policy to encourage an association of local producers, which are small and dispersed, as well as the lack of a policy for locally produced drugs, saying that the big producers have better incentives and support (they are referring mostly to the international companies, who have their own association in Romania).

It is important to note that not all linkages with the science sector are of a horizontal nature, as we observe cases in which science sector institutions are customers, and, moreover, in one important such case these science sector customers are foreign. The Hungarian advanced materials producer is a rare example of the systematic pursuit of collaborative R&D with external partners, although the Polish skin-care products producer has an interesting example of collaborative R&D, in which an institute testing the properties of folic acid in regenerating the DNA of cells damaged by ultraviolet radiation found by accident that it had same properties for cells damaged by X-rays. The Lithuanian laser technology producer company also conducts joint R&D and develops its R&D funding strategy jointly with the national physics institute from which it was spun off. Perhaps surprisingly, this firm also continues links with former Soviet research establishments.

5. Conclusions

The case studies of thirteen knowledge-based firms in six ECE countries presented here suggest that the KBE firms in these countries may differ in some important ways from the conventional picture of new technology based firms. To summarise the preliminary findings emerging from this study, in the table below we present a comparison of the 'textbook' knowledge-based firm (a new technology based firm) with a sort of stylised picture of the 'typical' ECE KBE firm.

Table 1. KBE in ECE compared with the global model: A stylised picture

	New technology based firm	**ECE knowledge based firm**
Mode of growth	Generic expansion	Productivity based expansion
Strategic objective	Commercializing results of IPR	Diversifying to exploit organisational capabilities
Model role	'Gazelle'	Knowledge broker/Specialized supplier
Structural feature	Trendsetter	Trend spotter
Market orientation	Global market	Domestic market
Key competitive advantage	New world frontier technology or product	Customer oriented organisational capabilities
Threshold barrier	IPO	From domestic brand builder and networker to established exporter

In general, we see the ECE knowledge-intensive firm as a knowledge-localiser or customiser, adapting global knowledge to local needs on the domestic market, rather than a knowledge-creator generating new solutions for global markets. The entrepreneurs who start and run these businesses are skilled at spotting trends early and bringing them to their countries. Based in countries that generally have poor reputations as sources of innovative, high-technology products, but having established strong brands for themselves in their home markets, they are struggling with the challenge of entering export markets with products and services that can achieve global, or at least regional, recognition. The studies of the companies discussed here suggest that ECE firms are still in the early stages of this strategic shift.

In comparison with the stylised new technology company, we observe a dearth of linkages of strategic importance for processes of innovation and product development. The role of networks with other firms (in the form of strategic alliances, research joint ventures, cooperation with supply chain partners, etc.) as well as with universities and research institutes has been richly described in the literature on innovation. While the ECE firms also engage in such cooperation, it tends to take place 'on the margins', as it were, of the

innovation process: customers supply raw ideas, universities and research institutes provide access to equipment with which to test raw materials and finished product quality, and so on. But these partners are not integrated into the product development process itself. That is kept quite strictly in-house. On the other hand, it seems that ECE knowledge based firms are far more networked than innovating firms in these countries as depicted in innovation surveys. This issue warrants further research and is based primarily on evidence on networking based on a sample of firms analyzed in WP3.

Firms in both case studies and for which data are collected in the sample within WP3 demonstrate a broader set of capabilities which form the basis of their growth and competitive advantage. In addition to advantages based on specific new technologies, most firms base their competitive advantages on broader sets of competencies which are related to localisation, knowledge of customer needs and the ability to differentiate themselves on local markets. It is surprising that only in two firms (both Lithuanian) the source of competitive advantage is technology in the form of IPR (patents). Here our research has not been able to generate a conclusive result. On one hand, the rarity of IPR as a competitive tool may be entirely due to specific nature of capabilities of ECE knowledge based firms which are mainly in localisation, customer orientation and organisational capability. On the other hand, it may be possible that ECE knowledge-based entrepreneurs in are often forced to resort to other forms of protection of intangible assets like lead time, secrecy, and technological complexity. It seems that one important reason for this is connected to the protection of intellectual property. Patenting is not seen as an effective form in countries where the processing of patent applications by patent offices and of patent violation cases by courts takes a very long time.[5] This is supported by Woodward et al. (2005), who find that those rare firms in two Polish traditional industries (clothing and furniture) who have patents tend to be reluctant to engage in cooperation in the sphere of innovation due to fears that their partners might abuse their access to their intellectual property, as well as to perceptions of the poor efficiency of the justice system in enforcing contracts. In the case of the Polish new technology based firm studied here, we observe both the difficulties related to patenting in the country and the reserved attitude towards innovation networking due to fears of abuse of its non-patented technology as obstacles to its healthy growth.

In our study, we noted somewhat surprising result that the companies studied generally enjoy a strong public sector share in their client base. But perhaps role of public sector should not be considered so surprising, as demand for knowledge intensive products and services on private local markets is still underdeveloped in the post-socialist economies,

[5] Although patent application processing time appears to be a growing problem in some Western countries as well; for the US case, see Bartz (2007)

forcing the KBE firm that wishes to be successful to successfully market itself and its products or services to public sector clients. On the other hand, the public sector in these countries has particularly strong needs in IT services related to the modernisation of public administration.

Some areas for future research using larger cross-country samples involving both ECE countries and older EU member countries are also suggested by our work. A cross-country comparison of the proportions of companies in knowledge-intensive industries that are genuinely new technology based would be interesting, as would a similar comparison examining the difficulties SMEs in such industries face in obtaining various kinds of external finance (such a comparison would do well to distinguish demand factors from supply factors and show how these differ between new and old EU member countries). A cross-country comparative examination of the role of public sector clients for such firms would also be very enlightening in the identification of possible demand-side barriers to their development. Last but not least, our research has demonstrated the relevance of the notion of knowledge based firms within which new technology based firms are a subset. In that respect, we see a huge scope for research which would explore structural features of new technology based (knowledge-creating) versus knowledge-customising or localising firms.

References

Aidis, R. (2005), Entrepreneurship in Transition Countries: A Review, London: School of Slavonic and East European Studies, University College London (available at http://www.ssees.ac.uk/publications/working_papers/wp61.pdf).

Bartz, D. (2007), Patent office says wait time likely to grow, Reuters, 14 November. Available on-line at http://www.reuters.com/article/domesticNews/idUSN1423368820071115?sp=true; last accessed 31 May, 2007.

BC Stats (2001), Business Indicators July 2001 (http://www.bcstats.gov.bc.ca/pubs/bcbi/bcbi0107.pdf; last accessed 31 May, 2007).

Ben-Ari, G., Vonortas, N. (2005), Risk Financing for Knowledge-Based Enterprises: Mechanisms and Policy Options. Mimeo.

Clendenning, E. Wayne, & Associates (2000), Comparison and Reconciliation of SIC and NAICS Industry Codes Used To Define Knowledge-Based Industries (KBIs). Prepared for Industry Canada, Small Business Policy Branch.

Etzkowitz, H. (1983), Entrepreneurial Scientists and Entrepreneurial Universities in American Academic Science, *Minerva* 21, 198-233.

Etzkowitz, H. (2003), Research groups as 'quasi-firms': the invention of the entrepreneurial university, *Research Policy* 32, 109-121.

Hirschman, A.O. (1958), *The Strategy of Economic Development*, New Haven: Yale University Press.

Hoshi, I., Balcerowicz, E., Balcerowicz, L. (2002), *Barriers to Entry and Growth of New Firms in Early Transition: A Comparative Study of Poland, Hungary, Czech Republic, Albania and Lithuania*, Boston: Kluwer.

Klepper, S., Thompson, P. (2006), Intra-Industry Spinoffs. Working Paper 0605, Florida International University, Department of Economics. Available on-line at http://www.fiu.edu/orgs/economics/wp2006/06-05.pdf (last accessed 4 January, 2008).

Knight, F. H. (1921), *Risk, Uncertainty, and Profit*, Boston, MA: Hart, Schaffner & Marx; Houghton Mifflin Company, 1921.

Penrose, E. (1995), *The Theory of the Growth of the Firm*, Oxford University Press, UK.

PricewaterhouseCoopers (2005), *Money for Growth – the European Technology Investment Report 2005*. Available on-line at http://www.pwc.com/images/emea/tech/MoneyforGrowth2005.pdf; last accessed 27 July, 2006.

Radosevic, S. (2004), "What Future for Science and Technology in Central and Eastern Europe in the 21st Century?" In W. Meske (ed.), *From System Transformation To European Integration: Science And Technology in Central and Eastern Europe at the Beginning of the 21st Century*, Münster-Hamburg-Berlin-Vienna-London: Lit Verlag.

Rigby, J., Bleda, M., Morrison, K., and Kim, J.-S. (2007), *Gazelles,* A Project for DG Enterprise and Industry, Louis Lengrand & Associés, PROInno Europe, GRIPS, Brussels.

Schumpeter, J. A. (1962) *Capitalism, Socialism and Democracy*, Harper Perennial; 3rd Ed edition.

Teece, D.J., Pisano, G., Shuen, A. (1997), Dynamic Capabilities and Strategic Management, *Strategic Management Journal* 18(7): 509-533.

Tsoukas, H. (1996) The firm as distributed knowledge system: a constructionist approach, *Strategic Management Journal*, 17, pp. 11–25.

Von Tunzelmann, N., Yoruk, D.E. (2004), Network realignment in the CEE food-processing industry, in McGowan, F., Radosevic, S., von Tunzelmann, N. (eds.), *The Emerging Industrial Structure of the Wider Europe*, London: Routledge.

von Hippel, E. (1988), *The Sources of Innovation*, Oxford University Press.

von Hippel, E. (2005), *Democratizing Innovation*, Cambridge, Mass.: The MIT Press. Available on-line at http://web.mit.edu/evhippel/www/democ1.htm (last accessed 4 January, 2008).

Woodward, R. (2006), Knowledge-Based Entrepreneurship in two transition countries. Paper prepared for European Association for Comparative Economics Studies (EACES) 9th Bi-Annual Conference, Brighton, September 7-9.

Woodward, R., Gorzynski, M., Kalukiewicz, A., Wojcik, P. (2005), Sieci innowacji w branzach tradycyjnych (Innovation networks in traditional industries), in R. Woodward (ed.), *Sieci innowacji w polskiej gospodarce: Stan obecny i perspektywy rozwoju* (Innovation networks in the Polish economy: Current state and development prospects), Warsaw: CASE.